



CAN A DISPUTED TECHNOLOGY MOVE KNOWLEDGE AND PRACTICE INTO THE FUTURE?

by Douglas Masini, EdD, RPFT, RRT-NPS, AE-C, FAARC

As a neonatal and pediatric intensive care therapist (or what we used to call a 'baby person' circa the 1980'), I proudly carried my positive experiences in newborn care with me to several facilities, both as a practitioner, supervisor and as a director. Since those days the caring professions have gone through (and continue to go through) tumultuous changes in monitoring, ventilation, and resuscitation of the infant, so much so that I feel a bit like a dinosaur when visiting the modern newborn nursery.

This article originally was designed to examine technology that provided data on the oxygenation of the fetus during the intrapartum (or laboring) period of the birthing experience. I also wanted to see if a disputed technology could act as a springboard for

new ideas that will eventually give data on the overall stability of the unborn baby while still in the intrauterine environment.

To set the stage, the year was 2002, and I was a green-as-grass clinical professor, fresh out of fellowship. While observing my students prepare to go to a high risk delivery, they were

buzzing about a new device, appropriately termed an intrapartum fetal oxygen saturation monitor that measured fetal oxygen saturation (or FSpO₂).

A soon-to-graduate Senior respiratory therapy student rattled off the indications, contraindications, uses, and research supporting this device. She stated that the probe would be inserted after the mother lost her water after the rupture of membranes, and the intrauterine pulse oximeter probe would be gently placed on the cheek of the singling infant while still in utero. The student explained that a 'safe' observed baseline value of FSpO₂ was greater than or equal to 30%.

Seeing any pulse oximetry value of 30% made me question if this parameter of 'normal' was in the foreground of the budding neonatal-pediatric respiratory care specialist. The hospital where I was teaching seemed excited at the possibility of a new device that, along with a stable or reassuring fetal heart rate tracing, would indicate the stability of fetal oxygenation during the later stage of labor. This device seemed particularly valuable when an unreassuring fetal heart rate was evidenced by electronic fetal heart rate (EFHR) monitoring (also called cardiotocography).

I also reminded myself that the FSpO₂ value of 30% was in concord with the teaching in our professional textbooks regarding

the fetal arterial oxygen of 16-18 mmHg in utero, variables of the developing fetus' hemoglobin dissociation curve, the behavior of left-shifted fetal hemoglobin, maternal placental oxygenation of the fetus, and normal post-parturition fetal umbilical arterial values.

I left the hospital that day believing I had witnessed another technological threshold that had been crossed. I must admit I was puzzled when I began researching this article to see that little had been published of late on this technique. I quickly found that the monitor and probe were still serviced by the manufacturer, but were no longer available in the United States. The manufacturer's website was barren of data, and sources in the popular media noted that monitor sales had been discontinued on November 1, 2005. So what happened to the promising technology behind intrapartum fetal oxygen monitoring?

A cursory look at intrapartum fetal oxygen saturation monitoring and its parameter, FSpO₂, revealed a number of studies and peer-reviewed data available in the obstetrics, gynecology and risk management literature starting in 1995. The technique was approved by the Food and Drug Administration in May of 2000, conditionally as an adjunct to electronic fetal heart rate monitoring (EFHR), especially in the case of a non-reassuring fetal heart rate, primarily based upon a study published by Garite and associates.

The device had a meteoric rise in sales with over 400 units in place by 2002. A simple online search revealed manufacturer's press releases announcing the advent of a new device in community hospital delivery rooms that, when combined with electronic fetal heart rate monitoring, gave substantial information regarding fetal oxygenation and stability. Simpson regarded the documentation of FSpO₂ important as an adjunct to delivery room risk management.

However, no sooner was the technology adopted but rumblings about the devices utility echoed through

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the obstetrics and gynecology community. Vidaeff and Ramin thought the technology offered insight into fetal hypoxemia and acidosis, but the technical artifacts, such as sensor-to-skin contact, acted to impede signal acquisition, and they questioned the cost effectiveness of fetal pulse oximetry.

A 2005 summation of evidence was published in the American College of Obstetricians and Gynecologists (ACOG) bulletin. These guidelines suggested that the use of fetal pulse oximetry could not be supported. Likewise, the work of Bloom and East concluded that fetal pulse oximetry was not effective in one of its primary indications, the reduction of cesarean section.

The fact that intrauterine fetal oxygen monitoring may have failed in its initial indication may lead one to think that the theory and the resulting instrumentation was a total failure. I would ask the reader to consider that, as in so many breakthrough technologies, the data gathered from intrauterine fetal pulse oximetry resulted in several major new discoveries. Simpson and James found that FSpO₂ improved with fluid bolus and a tight fitting, high concentration oxygen mask on the mother, a theory difficult to support without this technology. Important to respiratory care practitioners is the influence of intrauterine pulse oximetry on the research of Zourabian and Vintzileos whose work on a transabdominal fetal pulse oximeter will eventually give real-time fetal oxygen saturation noninvasively through the mother's abdomen. If this technology is successful, then this 'baby person' thinks FSpO₂ was a mis-step in the right direction.

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gas bubble is due to decompression sickness, hyperbaric treatment is still indicated. Another relative contraindication is with patients who have a history of optic neuritis. Although very rare, blindness has been reported anecdotally in this group of patients. One might think that glaucoma is a contraindication but it is not. This disease is marked by increased pressure in the eyeball that can lead to damage of the optic disk (area in the retina where the optic nerve enters the eye, also called the blind spot) and gradual loss of vision. In the case of refractive surgeries, hyperbaric oxygen therapy has not been shown to pose a problem.

There are differing opinions on the use and frequency of eye examinations in the hyperbaric setting. Drs. Butler and Hagan in "Physiology & Medicine of Hyperbaric Oxygen Therapy", recommend a pretreatment eye examination for any patient when a large number of treatments are indicated. The eye exam should consist of checking for changes in visual acuity, refraction, color vision, and status of the lens. A fundus (part of eye opposite the pupil) exam should also be performed. Other references appear to pay less attention to the use of ophthalmologist examinations in the hyperbaric setting and therefore I think this is a topic that deserves more discussion to guide hyperbaric center practices.

The last point to be made is that patients must be made aware of the potential effects that treatment may have on their vision. This should be an important topic in patient education and also a part of the signed patient consent. In most cases, vision changes are temporary and reversible and are not contraindications for therapy.

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